

CLAIMS

1. A method for continuously removing the unreacted butene-1, and optionally other volatile components, from a polymeric solution obtained by liquid phase (co)polymerization of butene-1, the method comprising the steps of:
 - a) subjecting the polymeric solution to heating and mixing conditions such that a mixture is formed consisting substantially of: (1) a polybutene melt containing entrapped butene-1 and (2) supercritical gaseous butene-1;
 - b) subjecting the above mixture to a sequence of devolatilization steps operating at decreasing pressures and at temperatures comprised between 170 and 220°C.
2. The method according to claim 1, wherein the other volatile components are comonomers, dimers, inert hydrocarbons, catalyst components and catalyst deactivators.
3. The method according to claim 1, wherein the polymeric solution obtained by liquid phase (co)polymerization of butene-1 is a solution of polybutene-1 in butene-1 containing unreacted butene-1 in a percentage comprised between 65 and 90% by weight.
4. The method according to claim 1, wherein the polymeric solution is fed to step a) at a temperature of 65-85°C.
5. The method according to claim 1, wherein the polymeric solution is fed to step a) at a pressure of at least 22 bar.
6. The method according to claim 5, wherein the polymeric solution is fed to step a) at a pressure in the range of from 25 to 80 bar.
7. The method according to claim 1, wherein the heating and mixing conditions of step a) are obtained by flowing the solution of polybutene in butene-1 through a multi-tube heat exchanger having static mixing elements inserted inside each tube.
8. The method according to claim 7, wherein said static mixing elements are mixing rods.
9. A method for continuously removing unreacted monomer, and optionally other volatile components, from a polymeric solution obtained by a liquid-phase (co)polymerization of butene-1, the method comprising the steps of:
 - a₁) subjecting the polymeric solution to heating and mixing conditions so as to cause part of the butene-1 to separate from the solution;

- a₂) subjecting the product obtained from step a₁) to a further heating such that a two-phase mixture is formed consisting substantially of: (1) a polybutene melt containing entrapped butene-1 and (2) supercritical gaseous butene-1;
- b) subjecting the above two-phase mixture to a sequence of devolatilization steps operating at decreasing pressures and at temperatures comprised between 170 and 220°C.
10. The method according to claim 9, wherein step a₁) is carried out in a heat exchanger using a heating fluid at a temperature not higher than 146°C.
11. The method according to claims 9-10, wherein step a₁) leads to the formation of liquid and/or gaseous butene-1 and of a polymeric solution having a concentration of PB-1 in butene-1 comprised between 40 and 70% by weight.
12. The method according to claims 9-11, wherein step a₂) is carried out in a heat exchanger using a high-temperature diathermic oil as the heating fluid.
13. The method according to claim 1 or 9, wherein the amount of butene-1 entrapped into the polybutene melt is less than 10% by wt.
14. The method according to claim 12, wherein the amount of butene-1 entrapped into the polybutene melt is less than 6% by wt.
15. The method according to claim 1 or 9, wherein step b) comprises two volatilizers connected in series, the first one operating at a pressure higher than the atmospheric pressure, the second one operating under vacuum.
16. The method according to claim 15, wherein the first volatilizer is operated at a temperature of from 170 to 220°C at a pressure of from 2 to 12 bar.
17. The method according to claims 15-16, wherein at the outlet of the first volatilizer the content of butene-1 in the polybutene melt is reduced at less than 3% by weight.
18. The method according to claims 15-17, wherein the polybutene melt coming from the first volatilizer is introduced into a second volatilizer operated at a temperature of from 170 to 220°C at a pressure of from 5 to 100 mbar.
19. The method according to claims 15-18, wherein at the outlet of the second volatilizer the content of butene-1 in the polybutene melt is reduced at less than 100 ppm.
20. The method according to claims 15-19, wherein a static mixer placed downstream the last volatilizer is used to carry out the compounding of the polymer melt.
21. A process for obtaining butene-1 (co)polymers comprising the following steps:
- (co)polymerizing butene-1 in liquid phase in the presence of a catalyst system

based on a transition metal compound to obtain a solution of polybutene-1 in butene-1;

- removing the unreacted butene-1, optionally together with other volatile components, from said solution according to the method of claims 1-20.